STUDIES ON THE SYNTHESIS OF TYROSINE IN THE ANIMAL BODY

BY

EUGENE EVERETT HOWE

B.S., Kansas State College, 1936

M.S., Kansas State College, 1937

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN CHEMISTRY IN THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS, 1940

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PART I

SYNTHESIS OF TYROSINE BY THE ALBINO RAT

Introduction

Womack and Rose[1] have proved conclusively that tyrosine is dispensable for the rat. The present investigation furnishes direct evidence that this amino acid can be synthesized by the animal body.

Experimental

The method used was analogous to that employed by Scull and Rose[2] in demonstrating the *in vivo* synthesis of arginine. Two litters of young albino rats served as the experimental animals. Each litter was divided into three groups. At the beginning of the feeding experiments, the members of one group were sacrificed, and each carcass was subjected to analysis to determine its tyrosine content. The animals in the two remaining groups were maintained on diets whose protein requirements were met by mixtures of analytically pure amino acids. The two diets were identical with the exception that tyrosine was excluded from one of them. After the subjects had each gained approximately 75 gm., they were killed and analyzed for tyrosine. Assuming that the initial tyrosine content of the experimental animals was the same as that of the controls, the results of the analyses indicate that the daily increment in tissue tyrosine is about 9 mg. per animal regardless of the presence of this amino acid in the food.

Summary

A series of rats have been maintained on a tyrosine-low diet. It has been shown that each of these animals deposited approximately 9 mg. of tyrosine daily in its tissues.

Bibliography

1. Womack, M., and Rose, W. C., J. Biol. Chem., *107,* 449 (1934).
2. Scull, C. W., and Rose, W. C., J. Biol. Chem., *89,* 109 (1930).

PART II

THE ORIGIN OF TYROSINE IN THE ANIMAL BODY

Introduction

Inasmuch as it has been demonstrated that tyrosine can be synthesized *in vivo,* the question arises as to which amino acid serves as its precursor. Phenylalanine, because of its close structural similarity, and because of indirect evidence supplied by Embden and Baldes[1] and by Womack and Rose[2], appears to be the most likely source. In view of this fact, it was decided to attempt to follow the conversion of phenylalanine into tyrosine by the use of deuterium as a tracer atom.

Experimental

Due to the fact that phenylalanine can undergo oxidative deamination or transamination to phenylpyruvic acid in the body, the only stable hydrogen atoms are those of the benzene nucleus. Accordingly, 5.1 gm. of dl-phenylalanine, containing 19.5 $\pm$ 0.2 atom per cent of deuterium* stably bound in the benzene ring, were synthesized from deuterobenzene by a series of reactions which gave an over all yield of 6.6 per cent. This material was fed to three male albino rats, two of which were maintained on a tyrosine-free diet, while the third received an abundance of tyrosine. The animals were killed, and the tyrosine was isolated from each carcass. These preparations have been submitted for analysis. The results are not yet available but will be within a few weeks. The findings will provide convincing proof for or against the hypothesis that tyrosine is anabolized from phenylalanine.

Summary

In order to determine whether phenylalanine is converted to tyrosine, dl-phenylalanine containing 19.5 $\pm$ 0.2 atom per cent of stably bound deuterium has been synthesized and fed to three albino rats. Samples of tyrosine isolated from these subjects have been submitted for analysis. The data should add considerably to our knowledge of the metabolic relationship of tyrosine and phenylalanine.

Bibliography

1. Embden, G., and Baldes, K., Biochem. Z., *55,* 301 (1913).
2. Womack, M., and Rose, W. C., Unpublished data, (1939).

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VITA

The writer was born at Keats, Kansas, on June 6, 1912. He was graduated from the Garrison, Kansas Rural High School in 1929. He entered Kansas State College as an undergraduate in 1932 and received the Bachelor of Science degree in 1936. During the year 1936-37 he was a graduate assistant in chemistry at Kansas State College, and received the degree of Master of Science from that institution in 1937. The same year he entered the Graduate School of the University of Illinois and has held a special research assistantship in biochemistry from 1937 to 1940.